Polyoxometalates as Inorganic Amino Acids for Biomedical Applications

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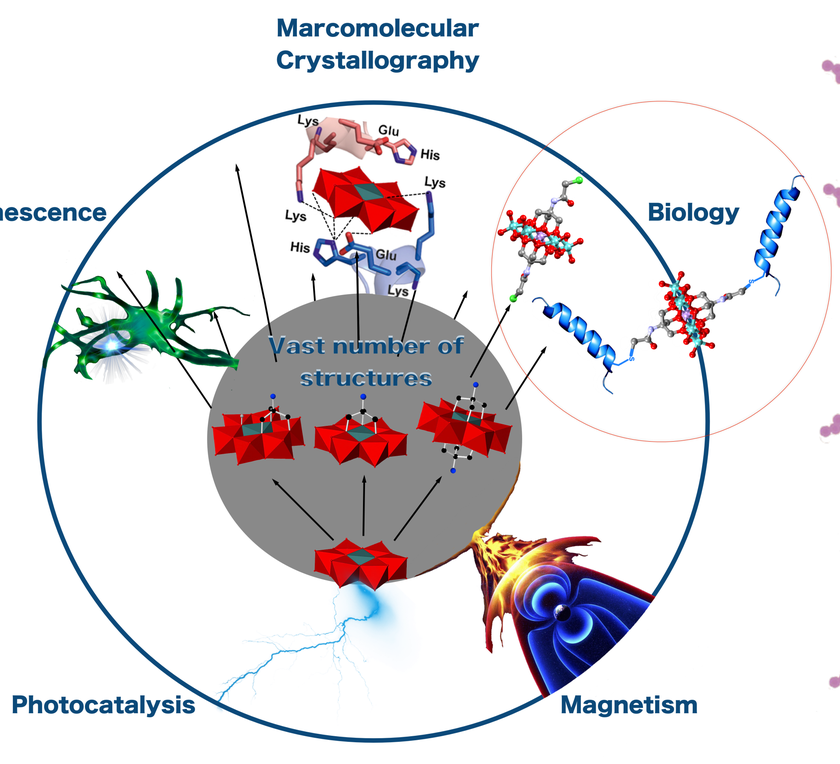
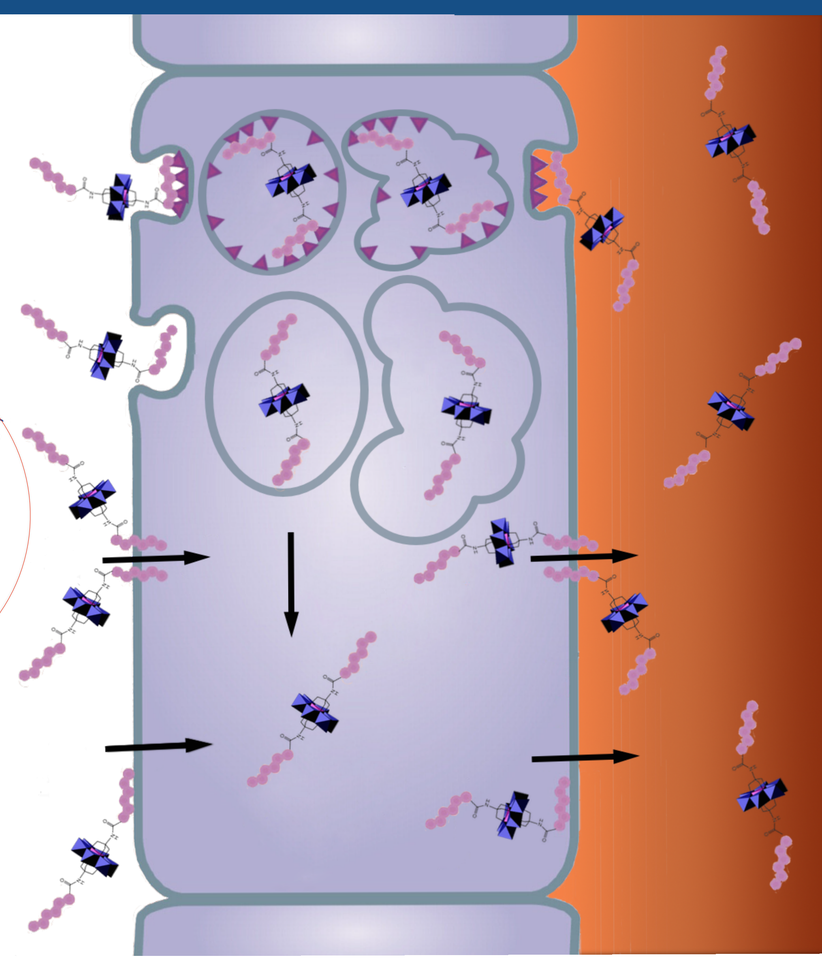
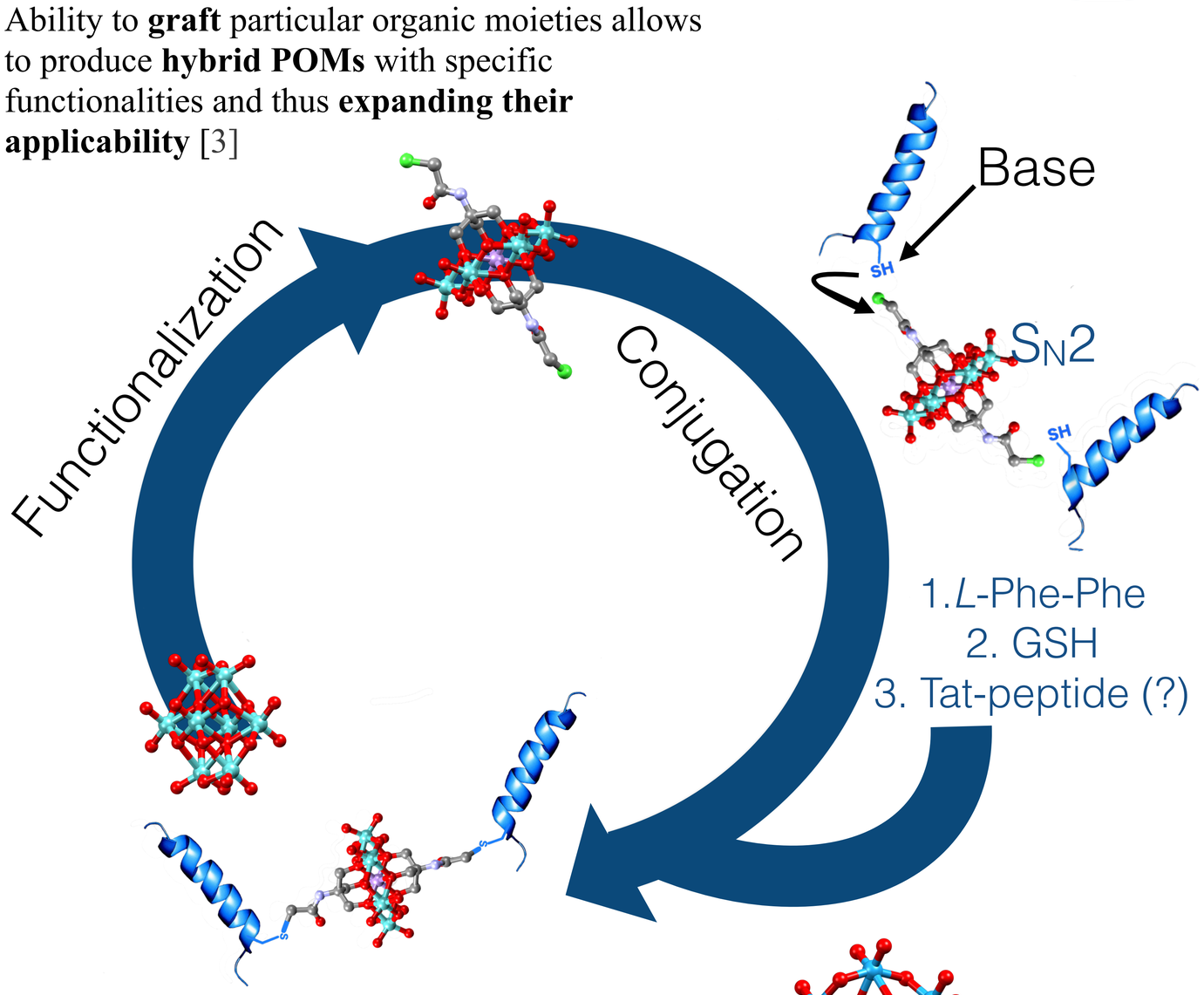
Introduction & Objective

- Polyoxometalates (POMs) encompass an enormous class of **polynuclear oxo-bridged early transition metal compounds** with rich topology, versatile chemical and physical properties
- This research comprises the study of **heteropolyanion** POMs ($[X_xM_mO_y]q-$, X = heteroatoms, more specifically the additionally complexed cations, e.g. first-row transition metals)
- The **Anderson POM** (APOM) comprises six edge-sharing MO_6 (MoO_6 or WO_6) octahedra enclosing a central, edge-sharing heteroatom of octahedral geometry XO_6 leading to a **planar arrangement** [1]
- New research areas in **biology** are highlighted since it is becoming one of the go-to POMs for biological applications based on recent results in macromolecular crystallography, tumor inhibiting, antibacterial and antiviral studies [2]
- Ability to **graft** particular organic moieties allows to produce **hybrid POMs** with specific functionalities and thus **expanding their applicability** [3]







Conclusion & Outlook

- A variety of hybrid POMs was prepared containing different types of organic handles in **successful bio-conjugation reactions.**
- Bio-conjugation with a **tat-peptide** will be tested.
- **Biomedical testing** will be performed to potentially **unravel** the **bio-activity** of these compounds.

References

1. M. T. Pope, A. Müller, *Angew. Chem. Int. Ed. Engl.*, **30**, 34 (1991).
2. P. A. Lorenzo-Luis, P. Gili, *Recent Res. Dev. Inorg. Chem.*, **2**, 185 (2000).
3. C. Yvon, A. J. Surman, M. Hutin, J. Alex, B. O. Smith, D.-L. Long, L. Cronin, *Angew. Chem. Int. Ed.* **53**, 3336 (2014).

Results & Discussion

- APOMs were first **grafted** simply with tris(hydroxymethyl)aminomethane, yielding the **single** and **double sided compounds** respectively $(C_{16}H_{36}N)_3\{Cr(OH)_3Mo_6O_{18}[(OCH_2)_3CNH_2]\}\cdot 12H_2O$ and $[N(C_4H_9)_4]_3[MnMo_6O_{18}\{(OCH_2)_3CNH_2\}_2]$. Afterwards they were manipulated to form **activated esters** (e.g. $(C_{16}H_{36}N)_3[MnMo_6O_{24}(C_{12}H_{15}N_2O_5)_2]$) through the formation of amide bonds, termed ***post*-functionalization** and to be conjugated by **coupling** to a L-*di*-Phe peptide
- The other part of the study examines the grafting of a tris-ligand bearing a chloride functionality, $(C_{16}H_{36}N)_3[MnMo_6O_{18}\{(OCH_2)_3C_3H_3NOCl\}_2]$, in a ***pre*-functionalized** manner towards an **S_N2 reaction** with glutathione. Finally, the latter was transformed to bear the organic azide handle $(C_{16}H_{36}N)_3$-$[MnMo_6O_{18}\{(OCH_2)_3C_3H_3N_4O\}_2]$ envisaging a **click reaction** with a biological relevant peptide, e.g. tat-peptide.